



Technological University Dublin
ARROW@TU Dublin

Articles

Learning, Teaching & Technology Centre

2010

Interaction Analysis in a ‘Learning by Doing’ Problem-based Professional Development Context

Roisin Donnelly

Technological University Dublin, roisin.donnelly@tudublin.ie

Follow this and additional works at: <https://arrow.tudublin.ie/lcart>

 Part of the [Higher Education and Teaching Commons](#)

Recommended Citation

Donnelly, R.: Interaction Analysis in a ‘Learning by Doing’ Problem-based Professional Development Context. *Computers & Education*, 55, 1357–1366. 2010.

This Article is brought to you for free and open access by the Learning, Teaching & Technology Centre at ARROW@TU Dublin. It has been accepted for inclusion in Articles by an authorized administrator of ARROW@TU Dublin. For more information, please contact yvonne.desmond@tudublin.ie, arrow.admin@tudublin.ie, brian.widdis@tudublin.ie.



This work is licensed under a [Creative Commons Attribution-Noncommercial-Share Alike 3.0 License](#)





This article appeared in a journal published by Elsevier. The attached copy is furnished to the author for internal non-commercial research and education use, including for instruction at the authors institution and sharing with colleagues.

Other uses, including reproduction and distribution, or selling or licensing copies, or posting to personal, institutional or third party websites are prohibited.

In most cases authors are permitted to post their version of the article (e.g. in Word or Tex form) to their personal website or institutional repository. Authors requiring further information regarding Elsevier's archiving and manuscript policies are encouraged to visit:

<http://www.elsevier.com/copyright>



Contents lists available at ScienceDirect

Computers & Education

journal homepage: www.elsevier.com/locate/compedu

Interaction analysis in a 'Learning by Doing' problem-based professional development context

Roisin Donnelly*

Dublin Institute of Technology, 14 Upper Mount Street, Dublin 2, Ireland

ARTICLE INFO

Article history:

Received 5 March 2009

Received in revised form

13 June 2010

Accepted 14 June 2010

Keywords:

Blended environments

Computer-mediated communication

Cooperative/Collaborative learning

Critical thinking

Interactive learning environments

Learning communities

Pedagogical issues

Problem-based learning

Professional development

ABSTRACT

This paper explores the concept and practice of interaction within a blended problem-based learning (PBL) module for academic professional development in higher education. A qualitative study spanning two years of the lived experiences of 17 academic staff in a blended PBL module was considered likely to provide a much-needed analysis of current thinking and practice on the potential of interaction. Relevant constructivist theories are applied to face-to-face PBL tutorials, online discussions, focus group interviews and reflective papers. For designers and tutors in blended PBL, it is important to seek best practices for how to combine instructional strategies in classroom and computer-mediated environments that take advantage of the strengths of each and avoid their weaknesses. Specific aspects of interaction (peer, tutor and the blended PBL learning experience) within face-to-face and online PBL tutorials are analysed to provide research-based information about the realities of delivering a PBL programme using a variety of current learning technologies.

© 2010 Elsevier Ltd. All rights reserved.

1. Introduction

Interaction has been and continues to be one of the most debated constructs in the realms of e-learning, problem-based learning and professional development, three fields of study in higher education that are relevant to this study. The ability to interact in technology-mediated learning – with students, tutors, content interfaces, features, code, channels and environments makes interaction undoubtedly a key value proposition. It continues to be perceived as the defining attribute for quality and value in a blended learning experience. Indeed Muirhead and Juwah (2003) argue that interactivity is critical in underpinning the learning process in face-to-face, campus based and distance and online education. They say that interactions serve a diverse range of functions in the educational process, which include learner–learner, learner–content, learner–tutor, learner–technology, tutor–content, tutor–technology, content–content. These functions promote and enhance the quality of active, participative learning in a learning environment.

While previous studies have explored interaction from the student perspective, McDonald et al. (2005) investigated student attitudes of the value and effectiveness of interaction, specific aspects of interaction amongst the triad of tutors and peers, and the blended PBL learning experience within problem-based learning tutorials have not thoroughly been analysed. Mapping interactions in a blended PBL professional development context is useful because it is an important step towards the understanding and formalizing how teachers can transform their learning and practice in both an online and face-to-face PBL environment. At the heart of this study is cognisance of the need for strong and effective interaction between pedagogy and technology to ensure that both are used to best effect in implementing PBL in a virtual environment. This paper discusses that by bringing the concept into sharper focus, real insight will be gained into the nature of interaction in blended problem-based learning environments.

It can be argued that interaction is the glue that holds all the pieces of this study together: problem-based learning, learning technology and professional development. Valsamidis (2006) has argued that focusing on the delivery of material instead of on the much more crucial interaction of the material with the learner, mediated by a tutor through a rich channel of communication, has resulted in a mismatch in how some

* Tel.: +3531 4027886; fax: +3531 6767243.

E-mail address: roisin.donnelly@dit.ie

professional development is designed. Within blended problem-based learning, there can be a particular sense of freedom provided by the relief of not having to “cover” basic information or design a course structure, but instead being able to concentrate on interaction with individual students and engage in a creative interpretation with each group of the issues and subtleties lying within and beyond content.

Interaction in the context of this study will be explored at two levels: interaction with people (peer learners and tutors) and the blended PBL learning experience. While the first level has been previously represented in a popular framework for interactive learning by Mayes and Fowler (1999), it is suggested that a case can be made for proposing a new dimension of interaction that focuses on the blended PBL interaction experience. The decision for this was based upon recognition that blended PBL is a complex process of interaction between people, the tools they use and the context in which they are embedded.

The paper begins with a discussion of the concrete value of interaction within the realms of (group) learning and instruction. Theoretical considerations are acknowledged and thereafter the case for the role of learning technologies in utilizing interaction is highlighted. A detailed description of the study into interaction within blended PBL is then provided.

1.1. The educational value of interaction

For the purposes of this study, interactions are defined as reciprocal events that require at least two objects and two actions, and they occur when the objects and events mutually influence one another. Many other definitions of interaction exist (Carlson & Reepman, 1999; Hirumi, 2002; Merrill, Li, & Jones, 1990; Sims, 2003; Wagner, 1994; Weller, 1988; Yun, 2005) and all provide a variety of reasons why interactivity in education is important. According to Vygotsky's (1978) social development theory, learning does not happen in isolation. A number of respected scholars including Ramsden (1988), Garrison (1990), Entwistle and Entwistle (1991) and Wagner (1994) have reported that increased levels of interaction have been shown to increase motivation, positive attitudes towards learning, higher satisfaction with instruction, deeper, more meaningful learning and higher achievement.

The literature widely mentions a communicative approach and cooperative and collaborative learning as methods that encourage an active and constructive learning and enhance the learner's autonomy, self-esteem and intrinsic motivation to learn. Collaborative learning is based on knowledge building that is possible thanks to the opportunities the participants have for real communication between themselves and tutors in a blended environment.

There has been much work conducted into interaction within groups of learners. Foulkes and Anthony (1984) examined the social view of group interaction taking places at different levels. Indeed there is a sociological understanding of one of the dimensions of interaction for describing groups, coined by Wagner (2006) as interactions as transactions.

Interactions have been researched in terms of four dimensions: transactions (interpersonal, academic, collaborative), outcomes, social presence and experience. Each of these four dimensions provide very different views on the value that interaction brings to a learning experience. They also share a number of similarities. Firstly, each perspective is shaped by some degree of technology-mediated learning and is looking for a way to transcend distance. Secondly, each assumes some degree of self-regulation and independence on the part of the learner. Thirdly, each acknowledges the value of facilitation by a tutor. In the context of this present study, this suggests that interaction strategies, regardless of their theoretical bases, can help improve the relevancy of blended PBL experiences for the participant. Table 1 depicts the variables of blended learning interactions central to this study in terms of their attributes and function; they have been considered for the work as they are central to the social and communal constructivist approach adopted in the module.

1.2. Interaction in virtual environments

Educational interaction is a complex phenomenon and as Anderson (2003) argues has long been a defining and critical component of the educational process, whatever the classroom context. However, the background of this study is in technology-mediated learning, and

Table 1
Blended learning interactions central to this study.

Variable	Attributes	Function	Contribution of my Study: Theory into Practice
Interactions as transactions	Learner collaboration	is the degree and quality of engagement with others	–Creation and sharing of ideas –Critiquing ideas –Deciding and agreeing to collaborate on an issue
Interactions as outcomes	Interaction for participation	Provides learners with a means of engaging with one another	Articulating one's interest in assuming leadership responsibilities in a group Teaching others in the group
	Interaction for communication	Offers the ability to share information and opinions or to influence intentionally the opinions or beliefs of others	
	Interaction for negotiation	Involves the willingness of another individual to engage in a dialogue, come to consensus or agree to conform to terms of an agreement	–Initiate dialogue with peers or the tutor –Dialogue on how they will agree on an issue
	Interaction for teambuilding	This is necessary to ensure that individual members of a team/group actively support the goals of the group	–Recognition and acceptance of individual differences –Expression of respect for the group as well as for its members –Effective listening –Shared sense of responsibility –Confirmation of expectations within the group

a number of schools of thought have emerged in the last two decades that explore interaction in this context. There are two commonly held beliefs. Firstly that the perceived quality of a learning experience is directly proportional to and positively correlated with the degree to which that experience is seen as interactive. Secondly, if technology-mediated learning designs are to have any significant impact on current and future pedagogical practices, then learning design decisions need to maximize the benefit of interaction.

Blended learning in the context of this study can be defined as combining face-to-face PBL tutorials with online support. The core characteristics of e-learning have been reported as: the provision of an authentic context for learning (Herrington, Oliver, & Reeves, 2003); a flexible and useable knowledge-base; its multiplicative communication properties (asynchronous interaction and dynamic control of time and space); multi-dimensional forms of communication and interaction (simultaneous intimacy and distance, multi-representational, hyper-searchable) (Garrison & Anderson, 2003). Graham (2006) offers up six major issues which are relevant to designing any form of blended learning systems: the role of learner choice and self-regulation, models for support and training, finding a balance between innovation and production, cultural adaptation and dealing with the digital divide and significantly for this current study, the role of live interaction. Yoon (2003) suggests that online interactions which can be stored, retrieved and disseminated anytime, anywhere are still a relatively new phenomenon and awaits greater exploration and coordination.

Interaction has long been regarded as the vital ingredient on which success matters in technology-related education. Research studies by Frankola (2001) and Charp (2002) on attrition rates in online courses have provided a rationale for the emphasis on promoting interaction and sound instructional strategies in online courses. More recently, Yun (2005) has concluded that there is evidence that instructional strategies which incorporate various types of interaction can be the key to teaching a high-quality online course that engages students. Student perceptions also provide a reason why interactivity is important in e-learning. A number of studies have shown that students tend to judge a distance education course according to their perception of the instructor–student interaction (Abbey, 2000; Flottechmesch, 2000; Lynch, 2002).

The literature identifies several taxonomies that classify various types of online interactions; however, Moore's (1989) seems to be the most well known taxonomy in the field of online education where he described three types of interaction: learner–content, learner–instructor, and learner–learner, which were found to be somewhat limiting and were later extended by Hillman, Willis, and Gunawardena (1994) to include learner–interface interaction. Wagner (2006) has discussed the concept of interaction in relation to blended learning and it is considered that this adequately serves as a demonstration of the breadth and vitality of the field. He contends that interaction should be viewed less as a theoretical construct and more as a variable that needed to be exploited, accommodated, leveraged or managed when crafting blended learning designs.

Interactivity is the core of learning, and is evident at all levels of engagement. Gredler (2005) in his consideration of learning and instruction, suggests that the role of technology in learning remains an issue for theory development and research. Specifically, yet to be developed are learning principles that address teacher–student interactions, student-to-student communication and student-to-subject-matter interactions for various uses of computer technology. There seems to be much evidence in the literature that as Internet-based teaching and learning have proliferated, researchers, theoreticians and pedagogues have recognized that an educationally viable environment requires students to interact with content and with each other. Within this, a number of outstanding issues remain to be addressed, including the nature of questioning, the character of informative feedback, the scheduling of reinforcements and the structuring of information for students.

There have been a growing number of useful studies in the PBL online settings literature that informed this present study. A study by ChanLin and Chan (2007) reported on the use of an electronic forum facility to provide support for PBL. Bach, Haynes, and Smith (2007) submit that PBL would seem particularly well suited to a blended approach where groups meet initially in a face-to-face setting, to establish social rapport and then move to online contact, such as ongoing asynchronous discussion where they explore the problem and share developing insights and the finding of new, related information.

There appears to be assorted support in the literature for the use of such forms of asynchronous communication for PBL. Some studies, such as Portimojärvi & Vuoskoski (2006) argue strongly from their research-base that online synchronous media best support the group-intensive, spontaneous nature of PBL. This view is shared by Savin-Baden (2006) as she posits that synchronous collaboration tools are vital for the effective use of PBL online because tools such as chat, shared whiteboards, video conferencing and group browsing are central to ensuring collaboration within the PBL group. In contrast, other studies such as Lim (2005), although arguably lacking in a sound methodological approach, contain some intriguing insights for my study. Supporting the idea of using discussion forums to support PBL in the context of legal education, Lim judges that they have potential to enhance collaboration.

On the key issue of whether critical discourse and thinking can occur in online interactions, there are still conflicting reports emanating from the primary literature on this point. Research by Rourke and Kanuka (2007) and analysis in Rourke and Anderson's (2002) study shows that most messages are in the category of comparing and sharing information. They report little evidence of the construction of new knowledge, critical analysis of peer ideas, or instances of negotiation. The discussions do not appear to foster testing and revision of ideas and negotiation of meaning which are processes fundamental to higher order thinking. Only a small percentage of contributions can be categorized as higher order cognition and awareness of knowledge building (p. 5). Several studies that use content analysis on the discussion board as a tool for higher order learning all point to a lack of critical thinking or discourse emerging. In one by Garrison, Anderson and Archer (2001), 42% of postings were brainstorming; 13% integration (construction of a possible solution to a problem) and only 4% of comments reflected higher order thinking; it has been found that students have higher levels of knowledge construction with moderately complex tasks, like a debate (where they are asked to take a position and justify it), compared to simple or overly complex tasks. A recent useful review study on critical thinking in online environments by Shedletsky (2010) considers whether this general lack of critical discourse in asynchronous tools is a function of what he calls 'some pervasive influence'.

Yet on the other hand, Kanuka and Garrison's (2004) report identify methodological constructs congruent with a model of community inquiry and higher order learning: they are discourse, collaboration, management, reflection, monitoring, and knowledge construction. This is an interesting polemical stance on the issue of critical thinking and discourse in online interaction that is worthy of further systematic research.

Dissenting opinion, challenges to others or expressions of difference, all need to be designed for and a structure put in place to enable them to occur. The literature has pointed to features that characterise collaborative meaning-making being small group size and purposeful

collaboration such as (problem centred learning or case studies). Arguably all this takes time to unfold – the right climate needs to be first set for peer critique as making controversial statements online – as there is a clear need to be careful about how things are perceived and interpreted. Seminal work on critical discussion in the classroom by Brookfield and Preskill (2005, p.6) – has been clear on the role of discussion for learning – it needs to help the learner reach a more critically informed understanding about the topic under consideration; it is supposed to enhance learner's self-awareness and capacity for self-critique; to foster an appreciation among participants for the diversity of opinion that invariably emerges when viewpoints are exchanged openly and honestly; and to act as a catalyst to helping people take informed action in the world.

At this stage arguably, we are left with more questions than answers on this issue. Can online discussion produce this type of critical thinking? If so, what factors need to be in place for this to happen? What is the role of the tutor in this? Can asynchronous online discussion (because it is written) enhance higher order thinking processes? Pena-Shaff and Nicholls (2004) believe that it can, and argue that in the process of explaining, clarifying, elaborating and defending our ideas and thoughts we engage in cognitive processes such as integrating (building a possible solution) and structuring.

Of central importance to this study on blended PBL, as f2f PBL tutorials are present instead of it being a fully online module, would there be more opportunities for peer critique? Dietz-Uhler and Bishop-Clark (2001) suggest that online discussion that precedes a face-to-face session encourages more participation in the f2f. This important point will be explored further in the study.

2. Material and methods

The focus of the research reported here is a professional development programme in higher education learning and teaching which was developed in 2001, and has over 100 graduates today. The 'Designing e-learning' module at the heart of this study is one of a number of ten week modules which carry ten ECTS (European Credit Transfer and Accumulation System) credits. The 17 participants on the module in this study were all either lecturers or educational support staff teaching in varied subject disciplines in higher education. The sample for this study was the total population (17 participants) of blended PBL groups undertaking the PBL module in the two years the data was collected in order to explore the lived experience of a heterogeneous population of academic staff in higher education; there were three PBL groups in this study, and all participants completed the ten week module.

The PBL approach in the module at the centre of this study can be summarized as including stages of problem identification, deconstruction, seeking and using knowledge and experience, understanding, thinking, choosing a strategy, acting and then critically evaluating and reflecting on the action. Although there are many variations of PBL that have evolved during its lifetime, a number of core characteristics prevail, which are the essence of the PBL context here: student-centred learning occurs in small groups; the teacher acts as facilitator; problems form the organizing focus and stimulus for learning and are the vehicle for the development of problem-solving and reasoning skills; and new information is acquired through self-directed learning.

The module used the 'WebCT' course management system, which provided both asynchronous and synchronous interaction tools. While WebCT technically organized the online environment of the PBL groups, actual interactions took place through the actions and reactions of the participants to the PBL learning setting, module materials and activities, to tutor and guest tutor directions and to peers' ideas and actions.

A naturalistic, interpretative, qualitative approach was used to analyse the data collected for this study. The open-ended, exploratory, qualitative approach taken in this present study can help document how learners in real PBL situations and contexts, addressing both broad themes and micro-issues helps us understand the complexity of learning and teaching in blended PBL environments and offers insights that can be useful in developing our practice as academic developers. As a research approach, it has presented a series of "slice-of-life" episodes during the blended PBL tutorial process and afterwards, revealing the range of applications and use of the knowledge in professional teaching practice.

The research methods employed to collect face-to-face and online observational data from three PBL groups with a total of 17 participants in this two year study on a blended PBL module were participant observation, online discussion logs, open-ended focus group interview and self-reflective papers to capture the participant's own thoughts and experiences of the blended PBL approach. Each method was chosen for the opportunity it could offer to explore interactions which were central to this study. The approach taken to the collection of data of blended PBL groups was multi-faceted. A main concern has been to provide meaningful and accessible insights into the practice of blended PBL based on the analysis of real-life situations. There were two levels taken to the analysis of the data. Level One was descriptive in nature and through video observations explored the interactions between the peers, the tutors and the content of the blended PBL tutorial. Level Two was a thematic analysis of interactions in blended PBL and through a combination of online logs, focus group interviews and participant self-reflective papers, categories and themes emerged to inform the findings of the study and implications for practice. Being engaged with the events as they happened in the field and attempting to bring holistic attention to the practices as constitutive of a distinct culture was important to this study. As suggested by Hine (2000, p.20), this study has examined those enduring practices through which the blended PBL groups have become meaningful and perceptible to participants.

In order to establish in a PBL tutorial setting the factors that govern the success of blended problem-based learning, the literature suggested the need to identify key interactional indicators. Therefore, the first analytical framework was formed from a conceptual framework based upon the literature on interactions in blended learning. Specifically the literature suggested a range of interactional learning indicators, which are illustrated in Table 2.

Two types of categories were included for exploration of the interactions in blended PBL: people (tutors and peers) and the blended PBL learning experience. For each category a set of indicators of learning were developed. The category of *tutor interactions* looked at indirect and direct tutor influence on participant learning and within this, specifically at participant interactions with the concept and content of the PBL problem. The category of *peer interactions* included responsive, initiative and unrequited peer discussions. To assist with the formation of categories, I found it helpful for each indicator of learning to develop a definition, criteria and keywords to look out for in the transcripts from the data. I found the analytical frameworks very useful for then examining examples from the participant observation sessions.

Two examples are included of how the categories for analysis were formed for tutor and peer interactions, based on reading of relevant literature (for example, Medley & Mitzel's, 1963 study on applying systematic observation to classroom interactions) in an attempt to understand the learning dynamics between them in the classroom PBL group setting. *Tutor interactions* used two indicators of learning,

Table 2

Part of the Coding Scheme for Identification of Interaction Types in Blended Problem-based Learning (Peer Learning Only Included).

Type of interactions					
Category	Tutor		Peer		
Indicator	Indirect tutor influence	Direct tutor Influence	Responsive	Initiative	Unrequited responses
Definition	Subliminal tutor role	Conscious tutor role	Reactive talk	Leading talk	Individual analysis
Criteria	The tutor accepts and builds upon the tone of the participant in a non-threatening manner	Tutor's moderating function	Participant response to tutor or fellow participant; Tutor or participant initiates the contact or solicits participant statement	Peers initiate dialogue with each other and the tutor	Explore f2f PBL tutorials and online discussions
Keywords	Affirming; Positive; Negative	Weave; Advice Examples; Summaries; Questioning; Clarification; Facts; Opinions; Directions	Replying; Answering	Involves the creation of ideas, critiques, collaboration and communication	In f2f tutorials: silence or confusion; pauses Online: Postings not acknowledged or responded to by peers
Myra			Declan I think the other aspect of the problem that we were going to try to look at is e-learning pedagogy and where it is useful. What part of the key skills learning would be more effective online? We need to use those ideas, and ascertain that everyone here is 100% sure that this can be applied with their own students.	We have everyone here in the tutorial now. I feel we nearly have it, I know it can be flushed out here rather than waiting til later to go online. This is the way forward for the next few days.	
Declan			Yes, for the models we should explore, if we are going with this idea, then social constructivism working in groups/pairs is key and so is constructivist tasks that the students are assigned and need to interact with.	What do the rest of you think on this? Are we all happy enough to go ahead with this stage of the problem?	

indirect and *direct tutor influence*. The tutor's indirect influence on the blended PBL tutorial can be evidenced by them accepting and building upon the tone of the participants in a non-threatening manner (their tone may be positive or negative); praising or encouraging participant action or behaviour; using humour to release tension; positive body language (in the face-to-face tutorials only) or developmental comments. The tutor's direct influence on the blended PBL tutorial can be evidenced by them asking a question about content and concepts of the PBL problem or the learning process with the intent that a participant answer; clarifying the participants' queries; or giving facts or opinions about process or giving directions (commands to which a participant is expected to comply). In the online PBL discussion forums, evidence was sought for how often threads were woven by tutors or peers (similar or linked messages or threads); how the tutors quoted text from other messages to build dialogue and to pick up on key messages and provide advice and summaries.

Peer interactions used three indicators of learning: *Responsive participant talk*, *Initiative talk of participant* and *Unrequited*. The rationale for this is that the validation of what and how a learner understands is considered to be rooted in communication – critical discourse – when learners are encouraged to challenge, defend and explain their beliefs, evaluate evidence and reasons for these beliefs and to judge arguments. Accordingly this form of learning is a social rather than a solitary process. Responsive talk referred to instances where the tutor initiated the contact or solicited participant statements and the participant responded directly back to the tutor. *Initiative talk of participant* refers to all instances where they initiated the discussion themselves. *Unrequited* refers to instances of *silence or confusion*, which could include pauses, short periods of silence and periods of confusion in which communication could not be understood by the participant observer. Two examples of interactional sequences between participants from the observation of the face-to-face PBL tutorial with the PBL group, Cyber Club Seven on 7th February 2006, are included in this coding scheme to illustrate the application of codes.

I acknowledge the subjective, partial and open-ended nature of my interpretation of the blended PBL participants' discussions and that it was I, not the participants that interpreted the data of the discussions (even though they participated in participant verification sessions). I interpreted my findings in the light of blended PBL literature and other literature. I also acknowledge that other interpretations of the data are possible. I concur with Morse, Barrett, Mayan, Olson, and Spiers (2002) that as a qualitative researcher, I need to reclaim responsibility for reliability and validity by implementing verification strategies integral and self-correcting during the conduct of inquiry itself. Cutcliffe and McKenna (1999) also put forth a compelling argument for this position and encourage researchers to return to the participants to attempt to gain verification. Any findings that were not recognized by the participants were identified and if disagreements existed, these were reported.

A 2 h participant verification session was held with two of the three groups in this study on 5th and 8th February 2007 respectively; the majority of participants attended, and both were audiotaped. The participant verification sessions were held to check, confirm and be certain about the findings from the study.

3. Results

The use of direct quotes is used in this section to provide evidence of both the shared enthusiasm for the blended PBL experience and also some real concerns voiced by the participants. Whenever possible by using the words of the participants themselves, key issues will be highlighted. For inclusion of all participant quotes, the following applies:

FG = Focus Group Interview (either indicated by 1 or 2 for the first or second interview)

RP = Reflective Paper (numbered 1–17 for each participant)

PO = Participant Observation (the date of each observation is provided)

F2F = face-to-face (abbreviation used in participant quotes)

Three main themes emerged: critical thinking in online interactions, the blended PBL experience and Synchronicity of peer and tutor support.

3.1. Critical thinking in online interactions

What is the capacity of the discussion forum (and other tools for online interaction) to elicit and support critical peer-to-peer interaction? Is the level of critical thinking linked to the notion of quality in postings? Many studies have reported that the better quality postings often come from late entrants to a discussion thread and this would reflect the literature on the benefits of asynchronous communication. It is important for the online course designer to ask at the outset, what do we want the discussion board for? If it is a support mechanism, then it is potentially acceptable for learners to include non-critical messages. However, if we want to use them to encourage discussion, and the zone of proximal development, then as many previous studies have reported, it is important to link it in with the assessment strategy. A concern here is that if this is the case, are we discouraging discussion at a trivial but useful level? As an example, if the tutor requires all postings to be backed up by a reference/example from literature, that would no doubt enhance the apparent criticality of the discussion posts, but very much reduce the volume.

A study by [Rourke and Kanuka \(2007\)](#) identifies three barriers to critical discourse – a confusion or lack of clarity on the nature and purpose of discussion posts; critiques of other posts were considered an attack and time constraints. Their work suggests using highly structured activities to encourage critical discussion. They also reported that students in their study found use for the discussion board beyond critical discussion.

Social interaction and cognitive presence in a blended PBL environment may be a more complex phenomenon because the participants were engaging in both face-to-face and online communication. The findings show that there were a number of complexities to the interactions in the module and different patterns of interaction between participants in the PBL groups in the blended environment. Tutor, peer and mentor support provided invaluable interactions and opportunities that enabled some participants to achieve a level of criticality in their learning.

In this current blended PBL study, having learner work subjected to sustained (constructive) criticism and finding new arguments to defend it was central to progress on the PBL problem. A majority of the posts were aimed at sharing of information on personal experiences, sources read, etc. One argument is that this may be a result of the way the discussion forums were set up and the questions posed by the tutor to stimulate discussion, but it may also reflect the inherent qualities of threaded discussions that pull learners towards this level of interaction. Chat rooms, on the other hand, seem to lend themselves to more ephemeral interactions: with a series of comments on socially checking in, joking, and within the realm of deciding where best to 'meet' online for the next PBL get together – making decisions.

The problem of an overall lack of online critical interaction is complex. While small group work usually forces even the most silent and detached learners to participate, internal conflicts are also a possibility to preventing higher levels of cognitive learning from taking place. One of the participants shared their own thoughts on this:

Whereas this movement between substantive and ephemeral contributions is natural in a face-to-face discussion, I find it distracting in the online forum because it takes more work to find my way around the interactions.(Loirin, FG2)

[Angeli, Valanides, and Bonk \(2003\)](#) reported in their study (where participants were asked to link field experiences to their readings and to discuss their ideas in an online discussion) that “students’ online discourse was mostly an exchange of personal experiences and did not reflect well-supported reasoning” (p.31). Similarly [Rourke and Kanuka \(2007\)](#) in a review of the literature reported that “observers of interaction as it takes shape in computer conferencing rarely report significant instances of critical discourse, dissenting opinion, challenges to others, or expressions of difference.” (p.835). When participants take a critical stance, they are committed to questioning and exploring even the most widely accepted ideas and beliefs. One of the defining characteristics of critical discussion is that participants are willing to enter the conversation with open minds. In this study, discussion posting and engaging in others’ postings helped clarify the PBL students’ own thoughts on learning issues. Indeed having a requirement to respond to others’ contribution can encourage what [Pena-Shaff and Nicholls \(2004\)](#) call *dialogical interactions*. However only a select few of the confident participants adjusted their views as a result of persuasive, well-supported arguments from others. This sense of confidence is important here. Are all participants confident enough to retain their original opinions when advice (or rebuttals) fall short? It was important to convey to them that although there are times when agreement is desirable, it is by no means a necessity all the time.

There appeared to be a level of critical discourse amongst these particular participants, evidenced both by online postings seeking critique of each others’ individual contributions in the PBL group and quotes from the focus group interviews and reflective papers. Critiquing ideas amongst the participants were an important feature of their group work.

Honesty has a lot to do with it. I had no problem saying, I do not understand this, have you any ideas, or if you want to change anything that I have put up on that posting, just change it, or what do other people think, will we just leave it out. I don't think anyone was precious about their own work.(Loirin, FG2)

A consideration in this not to be overlooked is the need for what McPherson and Nunes (2004) have argued for – better learner preparation in relation to online interaction and peer critique.

In the asynchronous learning context, cognitive capabilities were not as present at the same time online as in the f2f PBL tutorial. Evidence from one participant in a face-to-face tutorial is presented along with an online posting from the same week to illustrate this point.

Message no. 670 [Branch from no. 669]

Posted by **Sorcha** on Sunday, January 16, 2005 8:25pm.

Subject: Re: Role of the Learner

I think that we need to structure the content of the module better and we need this at this time. There are things to explore in relation to assessment and the role of the teacher but because of the short time involved till the 18th Jan. at times I feel a bit overwhelmed by what we have to achieve by then and I think a bit of structure will begin to clarify things a bit.

From my understanding now, the teacher can be more socially present early on by coaching, mentoring and helping the student get through their learning. But thereafter it becomes almost like one-to-one or group or peer learning, and I quite like that. I also liked how we are now looking at assessment holistically, in that we are bringing in both formative and summative sides.(Sorcha, PO, 18/01/05)

Articulateness and ability to synthesise information online was generally not as forthcoming as the literature on e-learning would suggest. The difference in expressiveness of ideas online in this study contrasts with the research by Ranno, Diers, and Birk (2005) who found that students in their blended course reported positive benefits of online discussion in terms of coherence of discussion reached compared to the face-to-face setting. Similarly, in a study based on a technology course for teacher development, Yeotis (2005) reported that each time participants contributed to the online discussion their responses showed a more fluent understanding of the content area.

One of the challenges of using online technologies to support professional learning through critical reflective writing is the struggle to legitimize informal horizontal dialogue. The development of self-knowledge and situated understanding, using the tools of dialogue and narrative, were unfamiliar forms of professional development to the participants. Valuing and sharing personal reflection for professional learning was initially seen as a potentially threatening form of exposure to the scrutiny of others. In addition, some participants struggled to move away from posting largely descriptive accounts of their learning on the module and it was not until the introduction of reflective prompts and a structured tutor formative feedback session half way through the module that they began to engage in critical reflection on the blended activities and their broader purpose and context.

Similarly with posting reflective writing on the asynchronous discussion forums, the participants' initial mistrust of perceived public spaces initially presented a barrier to participation for some and influenced the focus and form of discussions. Such online spaces have the potential to offer a disembodied yet sheltered environment within which to assert, explore, question and reformulate responses to professional practice problems. However, technological literacy and a readiness to reflect, enquire and change requires considerable levels of support and time, rather than speedy obligation. The length of time to foster a non-threatening and supportive community should not be under-estimated. If one is aiming for regular and autonomous sharing of ideas and reflective responses, it will take longer than the time available on this current module.

3.2. The blended PBL experience

In terms of the blended PBL experience, it was found better to use the online interactions to better prepare the learners for in-class tutorial activity. Dietz-Uhler and Bishop-Clark (2001) describe a study where students were given assigned reading to discuss, with some students having an online discussion prior to the in-class discussion and others who did not. They found that the former students had a greater range of perspectives and enjoyed the f2f activity more than the latter students. This points to a useful aspect of discussion boards – providing learners with a range of learning styles, more time and opportunity to discuss issues relevant to their learning than a purely f2f session might allow for.

The technology facilitated a burgeoning community within the module and beyond with international guest tutors and this is potentially a positive force for change in practice. The participants themselves believe that digital technologies will progressively extend opportunities to engage in collaborative reflective PBL practice across disciplines:

For me the video conferencing sessions on the module with the international guest tutor from Finland were key activating events; that along with the asynchronous interactions with the Australian tutors. We had things in common with them as fellow educators and they got us to consider big issues as their postings were very deep. We continued to liaise with them for weeks after the module closed and the Australian tutors invited us to participate in their own online courses with fellow teachers from there.(Ronan, Participant Verification Session 08/02/07)

Both Somekh (2004) and Webb and Cox (2004) concur that the underlying issue is that in addition to surface level technical issues that need to be overcome, the potential that new technologies afford will only be realised by deep changes to pedagogy, in which ICT is not simply bolted on to existing practices but is used as part of new ways of teaching and of learning. Video conferencing, especially if it takes the form of online desktop conferencing has the potential for affording new ways of learning as it provides a way of widening students' access to learners from different cultural backgrounds and organizations in other countries (Abbott et al. 2005; Martin 2005).

A participant may feel uncomfortable if (s)he is clumsy with handling the technology in the presence of peers. Taylor and Evans (1996) have characterised this as the 'untechnologised' lecturer in the literature on learning and teaching with ICT. With initial experiences with new technology, many participants become overly focused on handling it, and cannot at the same time also think about their learning (Collis & Moonen, 2001). Technical difficulties with equipment, including the video conferencing facility and the difficulties of relying on time- and place-dependent media like videoconferencing, invariably requires that technical support be available. However, the participants in this study felt positive about the experience once they overcame their initial concerns about the technology-mediated environment.

In a qualitative study, with data collected through student postings and interview comments, Huber (2005) reported that asynchronous discussions and problem-based learning are generally perceived by students as being satisfactory, are effective in learning course content and enhance transferability of knowledge to the field. The notion of the passive participant or 'lurker', to use the web-based vernacular, was raised in the findings but increasingly the term itself is becoming outmoded along with any justification for its presence in an online discussion. Savage (2007) has presented it as ROP (Read Only Participant) and Wenger (1998) suggests that lurking is legitimate peripheral participation. It is important that all learners know the criteria for participation – "is a few posts okay?" This leads us to ask ourselves, how much is enough? This is related to the idea of the volume of postings online – this can leave a student in a quandary between processing large volumes of postings (are they all quality postings?) and achieving genuine engagement with the topic.

In a group learning context such as PBL, exploring the participant experience in both the online and face-to-face environments is key. Conflict in groups has been researched in face-to-face settings, but the management of virtual conflict is still largely under-researched (McConnell, 2006). The findings in this study have indicated that conflict which occurred early for one group online was the result of lack of communication face-to-face which became magnified in the online environment and caused a degree of conflict amongst group members. The change in communication modality from oral in the face-to-face tutorials to written in the online space, resulted in frustration for some and appreciation of the strengths that each environment can bring:

Well I must say that I wouldn't have survived on this module without the f2f. I would not have been here at the end of the module as my frustration with the technology did not fully dissipate.(Maevae, FG2)

I think that the differentiation between f2f and online conversation and discussion is quite enlightening and illustrates the way we as participants in a collaborative problem solving process had moved back and forth between the two as we proceeded through the various stages of the problem.(Ronan, RP2)

Myers Kelson and Distlehorst (2000, p.167) have pointed out that common sense and personal experience tell us that "people often find themselves in groups with highly dissimilar individuals or working on problems far removed from individual purposes or expertise."

3.3. Synchronicity of peer and tutor support

Within inter-participant interaction, a number of facets were evidenced: peer tutoring, encouragement, sharing resources, personalization of learning experiences (experiential learning), community development, exemplar demonstration and development of virtual practice. Throughout the online discussions, there was ongoing positive acknowledgment of peer contributions:

Having completed a traditional PBL module (all f2f) and a blended module, the main difference between traditional PBL and online PBL is how and when the participants engage and interact with each other and give each other a pat on the back every time.(Darragh, RP17)

Peers taking over aspects of the tutoring role were evidenced by adopted weaving and summarizing tasks after week 5 and participants adopted seeking content clarification from each other after week 5.

Most people were relying on each other after having just done a PBL module and we felt we were able to do it within ourselves. We took a very humane approach with the problem, everyone was patient and tolerant of each other and I thought that was great and people were willing to offer you handouts and good ideas.(Loirin, FG2)

The transfer of agency and responsibility to each group did result in a radical change in the relationship and interaction between the tutor and the participants.

There was one incident where one of our group was very nervous online and she posted a query and all six of us responded to support her which was great.(Myra, Participant Verification Session, 05/02/07)

In two groups, 'The Apprentices' and 'Cyber Club Seven' all members felt comfortable not to post online if they had nothing to say because they knew each other face-to-face first.

I think you also need to be able to say I can make a mistake without feeling stupid. Anyone can make a mistake. I love coming into the f2f class and Padraig saying he encountered the same online problem the night before, and I feel great, it's not just me, and being confident to admit that to one another.(Loirin, FG2)

People can read a posting and accept it yet do not feel like responding "that's great" at that time; it may have been a great contribution, but it is yet another message saying very little of depth but could be important for peer reassurance online.(Maevae, FG2)

However, the participants' perception of how they were regarded by others and how others actually perceived them resulted in disengagement by some and online dominance by others. In the 2005–2006 data set, there was a case of conflicting social identities between for example, Declan and Ryan in the 'Cyber Club Seven' group.

I was concerned that I may have been perceived as pushing ahead too fast for some others in the group at one stage; so it was really a concern about how I was being perceived online as opposed to my f2f persona, and wondering how the others were going to react.(Ryan, Participant Verification Session, 05/02/07)

All three of the PBL groups successfully produced a collective end product of their work on the module, however only two of the groups worked harmoniously ('The Apprentices' and 'Cyber Club Seven'); the third group exhibited anxiety and division and required extra resources from its members in order to sustain itself and produce its collective end product. Anxiety became a major focus for this group, which had the effect of diverting it from effective collaborative working. The findings show that the place of emotion can be central to the effective work of PBL groups in a blended environment. The difference between these groups with respect to this theme and categories is used as a point of departure in order to show how an understanding of the dynamics of blended PBL groups may be of benefit to teachers and students working in this new environment.

As interaction by students with learning materials is asynchronous and can happen at any time, and the scope of materials is much broader as students can access information on the internet, the tutor cannot hope to be an expert in every aspect of what students may bring up, but move to a position whereby students can be guided through such material. In this regard, online tutoring is generally more demanding on tutor's time than in-class work (Mandernach, Dailey-Hebert, & Donnelly-Sallee, 2007).

A number of facets were evidenced with interactions between participants and the tutors: (provision of technical assistance, ideas, questions, dealing with disappointment, provision of encouragement, making comparisons/similarities/threads and the stimulating role of the interaction with the international guest tutors):

It would be very difficult to quantify the tutor's input over the entire module because it is not just about the time online responding to messages, it is all the preparation prior to that. In actual fact, the role never leaves you. You are all the time aware of the need to be thinking about it. From my perspective, the first 5 weeks for the tutor seemed very intensive, but since 18th January, you seem to have been happier to stand back somewhat. (Sorcha, FG2)

Another major aspect in a blended situation is the role of the tutor f2f and the eModerator and the main thing is knowing when you feel the group have attained enough confidence and have bonded sufficiently within themselves to step back. (Darragh, FG2)

Owston, Garrison, and Cook (2006, p.339) believe “sustained interaction between and amongst tutor and students leading to knowledge construction and validation requires an opportunity to share and test ideas in a secure environment and with a manageable number of students”. ICTs have both the capability of supporting and enhancing this engagement and the capacity to extend the learning experience to critically consider the technology itself and critically access and evaluate the wealth of information available in a virtual learning environment.

4. Conclusion

This paper has suggested that the educational value of interaction in the blended PBL tutorial stems from maximizing the strengths of both the face-to-face and online environments. Today, educators have more choice than ever when it comes to selecting types of interactions to include in their blended courses; unfortunately they often do not even know the potential of the tools that are available to them or how to use them effectively. To further confound the situation, the use of interactive technologies alone does not ensure meaningful interactions will occur in a blended course. Arguably, all decisions regarding types of interaction in a blended problem-based learning course should be driven by pedagogical principles and grounded in research.

References

- Abbey, B. (2000). *Instructional and cognitive impacts of web-based education*. Hershey, PA: Idea Group.
- Abbott, C., Grosbois, M., & Klein, M. (2005). A Beautiful House Built On Sand. What Makes e-Communication Projects Succeed – and Why Are They So Rare? *Technology, Pedagogy and Education*, 14(2), 225–239.
- Anderson, T. (2003). Modes of interaction in distance education: recent developments and research questions. In M. Moore (Ed.), *Handbook of distance education*. Mahwah, NJ: Lawrence Erlbaum.
- Angeli, C., Valanides, N., & Bonk, C. J. (2003). Communication in a web-based conferencing system: the quality of computer-mediated interactions. *British Journal of Educational Technology*, 34(1), 31–43.
- Bach, S., Haynes, P., & Smith, J. L. (2007). *Online learning and teaching in higher education*. Maidenhead: Open University Press.
- Brookfield, S.D., & Preskill, S. (2005). *Discussion As A Way of Teaching: Tools and Techniques For Democratic Classrooms* (2nd Edition ed.). San Francisco.
- Carlson, R. D., & Reepman, J. (1999). Web-based interactivity. *Web Net Journal*, 1(2), 11–13.
- ChanLin, L. J., & Chan, K. C. (2007). Integrating inter-disciplinary experts for supporting problem-based learning. *Innovations in Education and Teaching International*, 44(2), 211–224.
- Chap, S. (2002). Wireless vs. hard-wired network use in education. *Technological Horizons in Education Journal*, 29(8), 8–10.
- Collis, B., & Moonen, J. (2001). *Flexible learning in a digital world: Experiences and expectations*. London: Kogan Page.
- Cutcliffe, J., & McKenna, H. (1999). Establishing the credibility of qualitative research findings: the plot thickens. *Journal of Advanced Nursing*, 30(2), 374–380.
- Dietz-Uhler, B., & Bishop-Clark, C. (2001). The use of computer-mediated communication to enhance subsequent face-to-face discussions. *Computers in Human Behavior*, 17(3), 269–283.
- Entwistle, N. J., & Entwistle, A. (1991). Contrasting forms of understanding for degree examinations: the student experience and its implications. *Higher Education*, 23(3), 225–227.
- Flottechmesch, K. (2000). Building effective interaction in distance education: a review of the literature. *Educational Technology*, 40(3), 46–51.
- Foulkes, S. H., & Anthony, E. J. (1984). *Group psychotherapy. The psychoanalytic approach*. London: Maresfield Reprints.
- Frankola, K. (2001). Why online learners dropout. <http://www.workforce.com/feature/00/07/29/> Retrieved 14 March 2007.
- Garrison, D. R. (1990). An analysis and evaluation of audio teleconferencing to facilitate education at a distance. *The American Journal of Distance Education*, 4(3), 13–24.
- Garrison, D. R., & Anderson, T. (2003). *E-learning in the 21st century. A framework for research and practice*. London: RoutledgeFalmer.
- Garrison, D. R., Anderson, T., & Archer, W. (2001). Critical thinking, cognitive presence and computer conferencing in distance education. *American Journal of Distance Education*, 15(1), 7–23.
- Graham, C. (2006). Blended learning systems: definition, current trends, and future directions. In C. J. Bonk, & C. R. Graham (Eds.), *The handbook of blended learning. Global perspectives, local designs* (pp. 3–21). San Francisco: Pfeiffer.
- Gredler, M. E. (2005). *Learning and instruction: Theory into practice*. Upper Saddle River, NJ: Pearson Merrill/Prentice Hall.
- Herrington, J., Oliver, R., & Reeves, T. C. (2003). Patterns of engagement in authentic online learning environments. *Australian Journal of Educational Technology*, 19(1), 59–71.
- Hillman, D. C., Willis, D. J., & Gunawardena, C. N. (1994). Learner-interface interaction in distance education: an extension of contemporary models and strategies for practitioners. *The American Journal of Distance Education*, 8(2), 30–42.
- Hine, C. (2000). *Virtual ethnography*. London: Sage.
- Hirumi, A. (2002). The design and sequencing of e-learning interactions: a grounded approach. *International Journal on E-Learning*, 1(1), 19–27.
- Huber, L. (2005). Innovative Online Learning for the Postbaccalaureate Market. Paper Presented at the EDEN Conference, Cyprus, pp.3945–3950.
- Kanuka, H., & Garrison, D. R. (2004). Facilitating cognitive presence in online learning: interaction is not enough. *Journal of Computing in Higher Education*, 15(2), 30–49.
- Lim, C. (2005). The use of online forums to support inquiry in a PBL environment: observations from a work-in-progress. *British Journal of Educational Technology*, 36(5), 919–921.
- Lynch, M. M. (2002). *The online educator: A guide to creating the virtual classroom*. New York: RoutledgeFalmer.
- Mandernach, B. J., Dailey-Hebert, A., & Donnelly-Sallee, E. (2007). Frequency and time investment of instructors' participation in threaded discussions in the online classroom. *Journal of Interactive Online Learning*, 6, 1–9.
- Mayes, J. T., & Fowler, C. J. H. (1999). Learning technology and usability: a framework for understanding courseware. *Interacting with Computers*, 11, 485–497.
- Martin, M. (2005). Seeing is Believing: the Role of Videoconferencing in Distance Learning. *British Journal of Educational Technology*, 36(3), 397–405.
- McConnell, D. (2006). *E-learning groups and communities*. Maidenhead: The Society for Research into Higher Education & Open University Press.

- McDonald, J., Birch, D., Gray, A., Gururajan, R., Hingst, R., & Maguire, M. (2005). An exploratory study to determine students' perceptions of the value of interaction in an Australian classroom context and the perceived impact on learning outcomes. In: 'What a difference a pedagogy makes': Researching teaching & learning, 24–26 June 2005, Scotland.
- McPherson, M., & Nunes, M. B. (2004). The role of tutors as an integral part of online learning support. *European Journal of Open, Distant and E-Learning*. <http://www.eurodl.org/?p=archives&year=2004&halfyear=1&article=105> Retrieved on 27 May 2010 from.
- Medley, D., & Mitzel, H. (1963). Measuring classroom behaviour by systematic observation. In N. Gage (Ed.), *Handbook of research on teaching* (pp. 247–328). New York: Rand McNally.
- Merrill, D., Li, Z., & Jones, M. K. (1990). Second generation instructional design. *Educational Technology*, 30(2), 7–15.
- Moore, M. (1989). Editorial: three types of interaction. *The American Journal of Distance Education*, 3(2), 1–7.
- Morse, J., Barrett, M., Mayan, M., Olson, K., & Spiers, J. (2002). Verification strategies for establishing reliability and validity in qualitative research. *International Journal of Qualitative Methods*, 1(2), 131–140.
- Muirhead, B., & Juwah, C. (2003). Interactivity in computer-mediated college and university education: a recent review of the literature. *Educational Technology & Society*, 7(1), 12–20.
- Myers Kelson, A. C., & Distlehorst, L. H. (2000). Groups in Problem-based Learning (PBL): Essential Elements in Theory and Practice. In D. H. Evensen, & C. E. Hmelo (Eds.), *Problem-based Learning. A Research Perspective on Learning Interactions* (pp. 167–184). Mahwah, NJ: Lawrence Erlbaum Associates.
- Owston, R., Garrison, D., & Cook, K. (2006). Blended learning at Canadian universities: issues and practices. In C. J. Bonk, & C. R. Graham (Eds.), *The handbook of blended learning. Global perspectives, local designs* (pp. 338–350). San Francisco: Pfeiffer.
- Pena-Shaff, J. B., & Nicholls, C. (2004). Analyzing student interactions and meaning construction in computer bulletin board discussions. *Computers and Education*, 42, 243–265.
- Portimajärvi, T., & Vuoskoski, P. (10–14 July 2006). A promising alliance of PBL, CMC and leadership. In *Paper presented at the 10th international conference on experiential learning*. Hosted by the Brathay Academy in partnership with The International Consortium for Experiential Learning (ICEL).
- Ramsden, P. (1988). *Improving Learning: New Perspectives*. London: Kogan Page.
- Ranno, A., Diers, M., & Birk, T. (2005). Case-based problem solving: blending face-to-face and online discussion. In *Paper presented at 18th annual conference on distance teaching and learning*. http://www.uwex.edu/disted/conference/Resource_library/proceedings/02_57.pdf Retrieved 9 February 2007.
- Rourke, L., & Anderson, T. (2002). Using peer teams to lead online discussions. *Journal of Interactive Media in Education*, 1. <www.jime.open.ac.uk/2002/1>.
- Rourke, L., & Kanuka, H. (2007). Barriers to online critical discourse. *Computer-Supported Collaborative Learning*, 2, 105–126.
- Savage, T. (2007). Emergence Vs. Design - A Case Study of an Emergent Community of Practice in a Blended Learning Community in Post Graduate Education. Paper Presented at CAL'07. Trinity College Dublin 26–28, March.
- Savin-Baden, M. (2006). The challenge of using problem-based learning online. In M. Savin-Baden, & K. Wilkie (Eds.), *Problem-based learning online* (pp. 3–13). Maidenhead: Open University Press.
- Shedletsky, L. (2010). *Cases on Online Discussion and Interaction: Experiences and Outcomes*. Hershey, PA: IGI Global.
- Sims, R. (2003). Promises of interactivity: aligning learner perceptions and expectations. *Distance Education*, 24(1), 87–103.
- Somekh, B. (2004). Taking the Sociological Imagination to School: An Analysis of the (lack of) Impact of Information and Communication Technologies on Education Systems. *Technology, Pedagogy and Education*, 13(1), 163–180.
- Taylor, D., & Evans, P. (1996). Staff Development for Tutor skills in Problem-based Learning. *Medical Education*, 30, 356–366.
- Valsamidis, T. (August 29–31, 2006). Where is the "e" in e-learning?. Abstract from The Higher Education Academy *Information and computer sciences 7th annual conference* Dublin: Trinity College.
- Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes* (M. Cole, V. John-Steiner, S. Scribner, and E. Soubberman, Trans.). Cambridge, MA: Harvard University Press.
- Wagner, E. D. (1994). In support of a functional definition of interaction. *The American Journal of Distance Education*, 8(2), 6–29.
- Wagner, E. D. (2006). On designing interaction experiences for the next generation of blended learning. In C. J. Bonk, & C. R. Graham (Eds.), *The handbook of blended learning. global perspectives, local designs* (pp. 41–55). San Francisco: Pfeiffer.
- Webb, M., & Cox, M. (2004). A Review of Pedagogy Related to Information and Communications Technology. *Technology, Pedagogy and Education*, 13(3), 235–286.
- Weller, H. G. (1988). Interactivity in microcomputer-based instruction: its essential components and how it can be enhanced. *Journal of Educational Technology Systems*, 28(2), 23–27.
- Wenger, E. (1998). *Communities of Practice: Learning Meaning and Identity*. Cambridge: Cambridge University Press.
- Yeotis, C. (2005). Increasing the depth of conceptual understanding through online discussion boards. In C. Crawford (Ed.), *Proceedings of society for information technology and teacher education international conference* (pp. 1682–1688). Chesapeake, VA: AACE.
- Yoon, S. (2003). In search of meaningful online learning experiences. In S. R. Aragon (Ed.), *Facilitating learning in online environments. New directions for adult and continuing education*. San Francisco: Jossey-Bass.
- Yun, K. (2005). Collaboration in the semantic grid: a basis for e-learning. *Applied Artificial Intelligence*, 19(9 & 10), 881–904.